



## DESIGN AND DEVELOPMENT OF CIRCULAR SHEET CUTTING MACHINE

Mihir patel<sup>1</sup> Hardik Prajapati<sup>2</sup> Shivansh patel<sup>3</sup> Prof. Darshan K. Bhatt<sup>4</sup>

B. Tech mechanical Engineering,

Indus Institute of Technology

### Abstract-

In this project we will design and manufacture circular sheet cutting machine. A circular sheet cutting machine is a machine which cut a square metal sheet in to a circular shape. In the industry circular sheet metal cutting process is one of the most important process all the smally to big products need sheet metal work. In this project we will design and manufacture a motorized circular sheet cutting machine from mild steel metal. This machine we will be manufacturing it a low cost and can be occupied in a less place. This machine gives more work output in less time. It is easy to transport and an assemble this machine. In this project the Metal sheet will be cutting in a circular shape with the help of shearing operation

Keywords -. Circular cutting machine, Pulley, WPS material, holding tool

### 1. INTRODUCTION

Sheet Metal Cutting is a very important process in many Industry segments. Fast growing industry segments like automotive have fuelled the growth opportunities of sheet metalworking. Sheet metal can be cut and bend into a variety of shapes finding

numerous applications in car bodies, airplane wings, medical tables, roofs for buildings and many other things. Almost all machine manufacturing houses- textile, plastic processing machines, printing machines, packaging machines, pharmaceutical machines, chemical plants, distilleries, breweries project etc are building main frame and majority parts from the sheet metal. In India, traditionally, the task of metal sheet cutting is accomplished using manual or semi-automatic machines like gas cutting machines, pug machines, circle cutting machines etc.

Circular Cutting Machine is one of the principal machines in sheet metal industry. It is mainly used as the name indicates to cut circles of sheet material. There are many machines in the industry which are able to cut sheet metal plate in a circular shape. Like cnc machine, Nc machine and hand operated machines etc.

Sheet cutting processes are those in which a piece of sheet metal is separated by applying a great enough force to caused the material to fail. The most common cutting processes are performed by applying a shearing force, and are therefore sometimes referred to as shearing processes. When

a great enough shearing force is applied, the shear stress in the material will exceed the ultimate shear strength and the material will fail and separate at the cut location. This shearing force is applied by two tools, one above and one below the sheet.

## 2. LITERATURE REVIEW

**Manik et. al** <sup>[1]</sup> has worked on Metals play a major role in the industrial and everyday life of human beings. Hundreds of welded metal objects and parts are used in engineering and household applications. Thus, the study of stress, strain & hardness in the welded area are so much important. This paper focuses on the study of mechanical properties of mild steel & cast iron before and after welding. It was seen that the stress of mild steel & cast-iron bar decreased after welding for any cross-section due to heat treatment of metal. After welding the hardness of the mild steel & cast iron increased because of rapid cooling. During experiment it was seen that the proportional limit of the specimens decreased due to effect of welding. It was also observed that the strength of the specimens decreased but hardness increased. Thus the property of the specimen can be changed due to welding effect.

**B. KIM** <sup>[2]</sup> has worked on Improving the durability of an automotive V-belt pulley, which is commonly used in an automotive powertrain to transfer power to other parts, is discussed. Fatigue life of the original V-belt pulley is predicted based on damage analysis by finite element analysis (FEA). Stress history of the pulley during operation was found by performing consecutive static analyses on the pulley as the pulley rotates.

**T. C. Firbank et** <sup>[3]</sup> at has worked on The mechanics of the belt drive is considered when the

belt possesses a soft pliable envelope to grip the pulley and strong tension members to transmit the power. It is concluded that shear strains in the belt envelope are a large factor in determining drive behavior. This is in contrast to the Elastic Creep Theory which explains the traditional belt drive in terms of longitudinal strains.

**B. Sivakumar et.at** <sup>[4]</sup> has worked on A gear or “gear wheel” is a rotating machine part having cut teeth, or cogs, which mesh with another toothed part in order to transmit power. Two or more gears working in tandem are called a transmission and produce a mechanical advantage through a gear ratio and thus may be considered a simple machine.

**Berna Balta et.at** <sup>[5]</sup> has worked on One of the concerns in belt drive transmissions is the relative sliding (slip) of the belt with respect to the pulley, which results in speed loss, i.e., decrease in the angular velocity of the driven pulley. In this study, the slip behavior of a V-ribbed belt drive with two equal-sized pulleys is investigated by utilizing several experimental methodologies. The individual effects of belt-drive parameters on speed loss are determined using one-factor-at-a-time (OFAT) test method. The relation between the belt-drive parameters and the speed loss is found using response surface method (RSM).

## 3. DESIGN AND CALCULATION

### 3.1 Design:

design calculations of various components and with the help of that calculations we have done modeling of in Circular sheet cutting machine solid works.

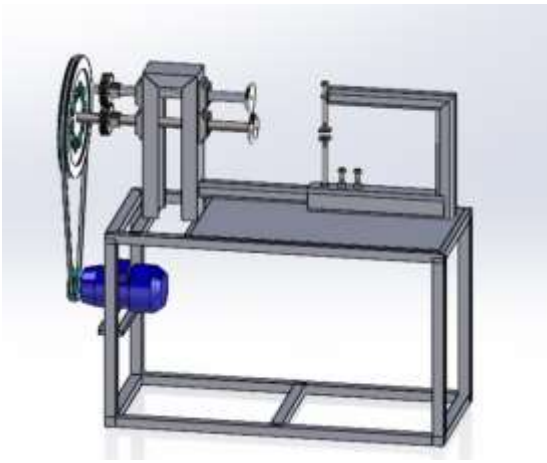


Fig 3.1 Molding of circular sheet cutting machine

### 3.2 Calculation and specification:

we have designed some components by calculating various parameters.

#### 1.pulley system

Diameter of driver pulley is 4 inch and Diameter of driven pulley is 15 inch.

RPM of Driver pulley is 1440 rpm.

We are calculating of Driven pulley using Equation of,

$$N_1 * D_1 = N_2 * D_2 \quad \dots (3.1)$$

Eq. 3.1  $N_1$  and  $N_2$  is RPM of pulley

Or  $D_1$  and  $D_2$  is diameter of pulley

Put Value  $N_1$ ,  $D_1$ ,  $D_2$  in Eq.3.1. after put value we find rpm of Driven pulley is 384.

After rpm calculation we calculate torque for standard equation.

Driver pulley Torque is 6.6313 Nm and Driver pulley Torque is 24.87 Nm.

#### 2.Motor

We are purchase single phase 1HP motor. Speed of motor is 1440 rpm. Diameter of motor shaft is 16mm. torque of 1Hp motor is 43.76 inch pound.

#### 3. MS box pipes

We purchase 4 Different size of box pipe.

Length of Box pipe is 0.2921m, 0.381m, 0.254m and 0.5207 m.

We are calculate Weight of box pipe using Volume and density of MS box pipe. Weight of box pipe is 10.402Kg.

#### 4. Normal stress

We are finding normal stress from holding tool of machine. Holding tool part like as cantilever beam.

Using equation of normal stress is 0.00000925593.

#### 5.Circular shaft

We are purchase 1.397m length of MS circular shaft. Total Weigh of shaft is 7.82Kg.

### 4.Fabrication of Circular sheet cutting machine

In fabrication process, we have purchased c-channel as a raw material with width 4inch x height 2inch x thickness 4mm and length is 44inch. 44inch c channel cutting in three parts, after cutting Weld in particular shape as requirement of machine. After that we again purchased one MS shaft of 50inch and cut them into 2 equal pieces 25inch each and with the help of lathe machine we made a key way and screwing. To continue, we made a wooden sample of our pedestal and give it for casting of total 4 pieces and in our pedestal, we fix ball bearing in those pedestals.



Fig 4.1 Fabrication of c-channel and shaft

we want to market for WPS raw material after the we cut it according to our 110mm diameter. To continue we done some work on it with lathe we done turning process and final diameter was



100mm. After that we made key slot in both the material further done some tempering at 50 to 55 degrees Celsius. And along with the help of grinding machine we got our accurate sharpness.



Fig 4.2 cutting blade

We purchase 3 box pipes with 3 different dimensions 15 inch, 12\*3 inch. After that we made c shape with welding process. We purchase some other material for that such as 10- and 6-inch bolt, 2 bearing, 2 bush bearing, 2 bolt 1.5 inch. we weld and made a c shape on bottom of that we weld 2 bolts so we can adjust as per different dimensions. 10inch nut and bolt weld in bottom and upper side of box pipe face side. Upper side bolt is adjustable and bottom side bolt is fix.

After fabrication we are assemble all part. After assembly ready machine.



Fig 4.3 Actual circular sheet cutting machine

machine in which a square Metal sheet cut into a circular form and we are able to cut M.S, S.S, GRE sheet up to 2mm thickness and we got the satisfactory output.

## 6.References

- 1) Manik, P K Halder, N Paul, "Effect of welding on the properties of Mild steel & cast iron specimen", February 2013.
- 2) B. Kim, Y. Kim, D. M. Chun, "durability improvement of automotive v-belt pulley", Vol. 10, No. 1, pp. 73-77 (2009).
- 3) T. C. Firbank, "Mechanics of The Belt Drive", July 1970,
- 4) B. Sivakumar, I. Joe Michael, "Design and Stress Analysis Of Spur Gear", Volume: 05 Issue: 05 | May-201.
- 5) Berna Balta, Fazil O. Sonmez, Abdulkadir Cengiz, "Speed losses in V-ribbed belt drives", April 2015.

## 5.Conclusion

In conclusion our main was to manufacture a low cost and Easy to assemble circular sheet cutting